Space Weather Technical Forecast

Issued on Tuesday, 07 June 2022 at 13:28 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Slight chance of a glancing blow from a weak CME late on 7th into the 8th June, but low confidence. Otherwise, no significant activity.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Very Low over the past 24 hours, with X-ray activity measured at GOES-16 confined to B-class. There are now just two numbered sunspot regions on the disc, with both stable, unproductive in terms of flares, and magnetically unipolar. Potentially adding to these numbered regions, a third spot group developed in the southwest, reaching Bxo/Beta classification, with no flares produced. A minor coronal dimming was observed in the northeastern quadrant around 06/1300UTC, however any resultant Coronal Mass Ejection (CME) is not apparent in coronagraph imagery, and no other CMEs were observed in the 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR, is in a slow regime, despite the arrival of a weak CME yesterday, possibly that from filament eruption(s) on 01 and 02 June.The solar wind speeds have been at background levels, between 300-340km/s, during the past 24 hours. Density has been above average, with a peak of 46ppcc around midday on 06 June, before declining as the effects of the CME waned. IMF peaked at 13nT, with the all important north-south component ranging +13 to -7nT. The phi angle drifted within a mainly negative sector (towards the sun) but fluctuated slightly following the CME's onset, between 06/1200-1500. The net effect of the above solar wind measures was predominately Quiet geomagnetic activity, with Unsettled (Kp3) intervals, following the arrival of the CME on the 06 June.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) has been at Background levels. Electron flux was mainly within Normal Background levels in the period. Electron fluence was initially above the Active (1e8 integrated pfu) threshold, but with a sharp declining trend observed, falling from 1.92e8 integrated pfu at 06/0000UTC to 5.69e6 at 07/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be Very Low initially. Returning active regions may increase the risk of flares from midweek UTC, although the degree to which this occurs is uncertain pending arrivals over the eastern limb.

Solar Wind / Geomagnetic Activity: The effects of the CME which arrived on 06 June continue to wane during day 1 (07 June), with a slow solar wind regime. There is a Slight Chance of Unsettled (Kp3) or Active (Kp4) intervals, with a very low risk of G1/Storm, being attained if the slow wind is again interrupted later on day 1 (Tuesday 07 June and into Wednesday 08 June) by a possible glancing impact from another CME which left the northeast quadrant on 04 June. Low confidence.
Quiet conditions should otherwise again predominate after any CME interjection, ahead of a

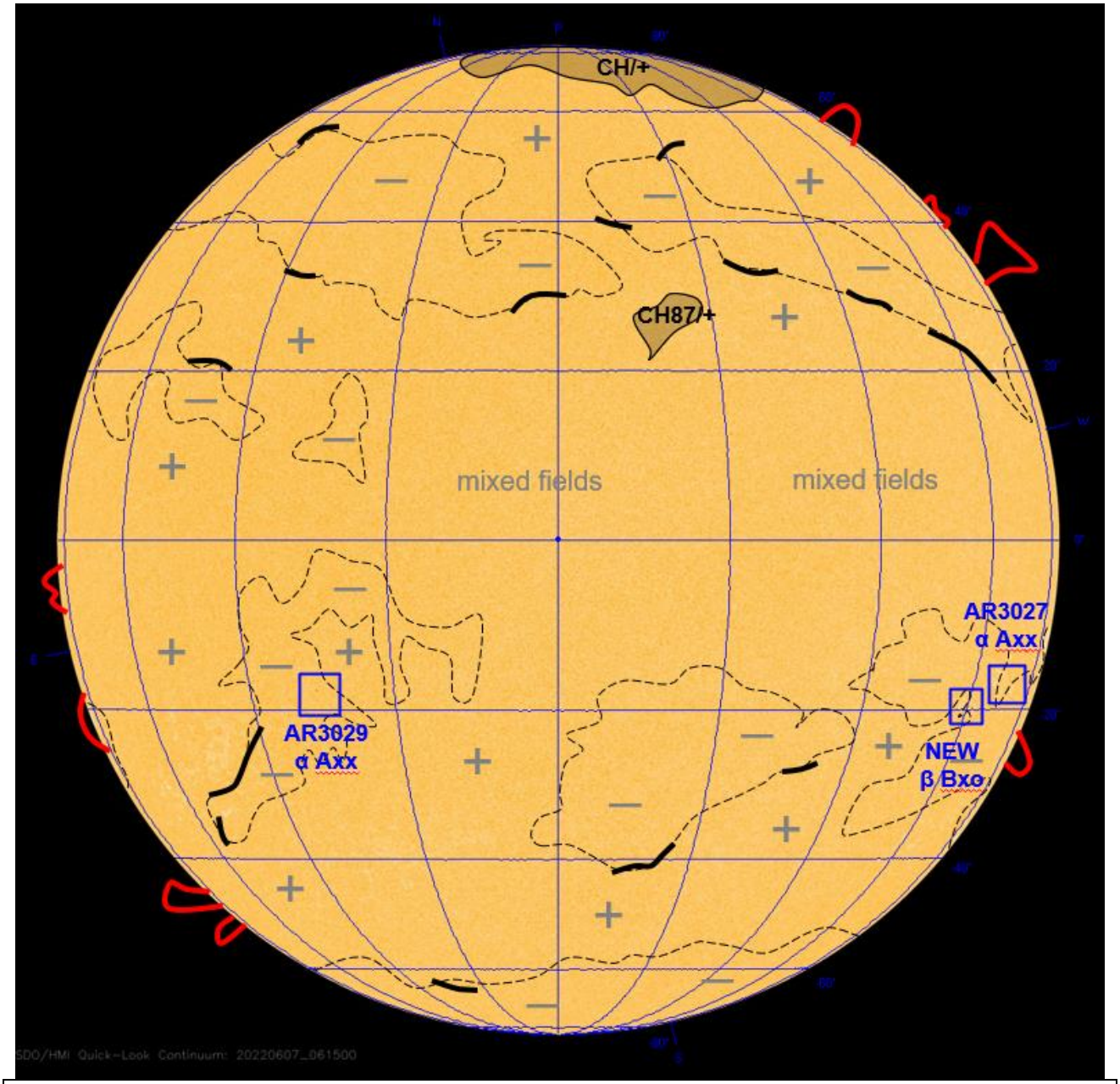
Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

possible minor coronal hole high speed stream arriving at the very end of the forecast period (from CH87/+), with this perhaps offering Unsettled intervals with a Slight Chance of Active on day 4 (Friday 10 June).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10 MeV) is expected to be at Background levels during this period.
High energy electron flux (greater than 2MeV) is expected to vary between Normal Background and perhaps Moderate levels. Electron fluence is expected to remain below the Active threshold throughout, and perhaps for the next week for a lack of forecast potent coronal holes, although confidence in this assertion falls with time.

Figure 1. Solar Analysis Valid 07/0615UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Geomagnetic Storms:

Effects from the 01/02 June CME have waned through the past 24-hour period, leaving a slow solar wind regime. There is a Slight Chance of Unsettled or Active intervals (should stay below G1 threshold), being attained if the slow wind is again interrupted later on day one (Tuesday 07 June and into Wednesday 08 June) by a possible glancing blow from another CME which left the northeast quadrant on 04 June. Low confidence in this aspect of the forecast.

Quiet conditions should otherwise again predominate after any CME interjection, ahead of a possible minor coronal hole high speed stream arriving at the very end of the forecast period (from CH87/+), with this perhaps offering Unsettled intervals with a Slight Chance of Active on day 4 (Friday 10 June).

STEREO A MAG and PLASTIC data is not showing any obvious enhancement at present, and the fact its observed phi angle remains negative implies that any influence from CH87/+ is yet to manifest at the satellite, putting it beyond 2.5 days' time in terms of any effect at Earth. CH87's small stature and Earth's approach to the solstice ought to mitigate against any significant activity in any case, with Active Kp a slight prospect.
The sub-Earth point crossed the solar equator northwards during the UTC day of 06 June and will spend the next six months more directly sampling northern hemisphere solar features.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	2	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

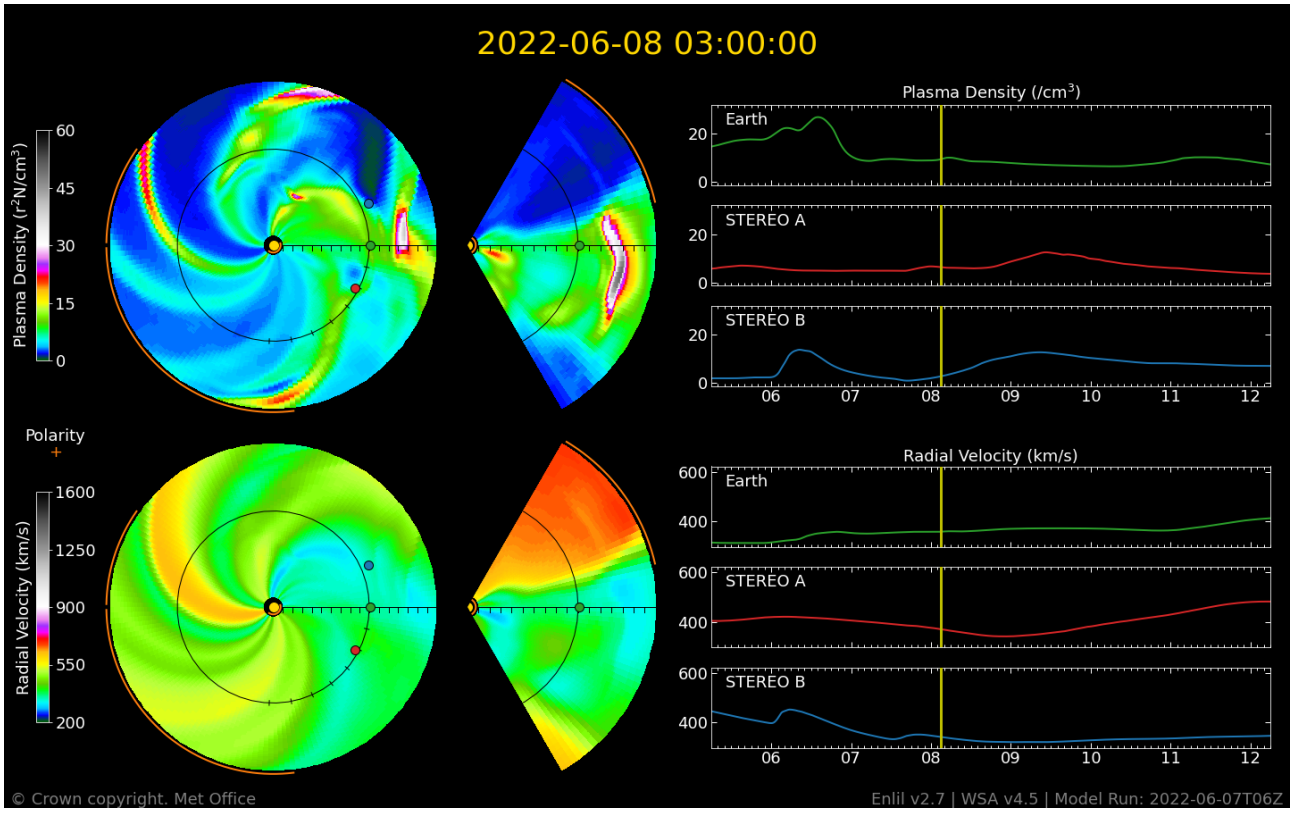
Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
04/1032 32 N 30 E	Partial	Filament Eruption	32 N 30 E	620km/s	Most likley missing	Glancing blow possible 07 into 08 June

Figure 2: ENLIL shows a possible glancing blow from a CME late on 07 June into 08 June – although more likely to be a miss.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Space Weather Technical Forecast



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

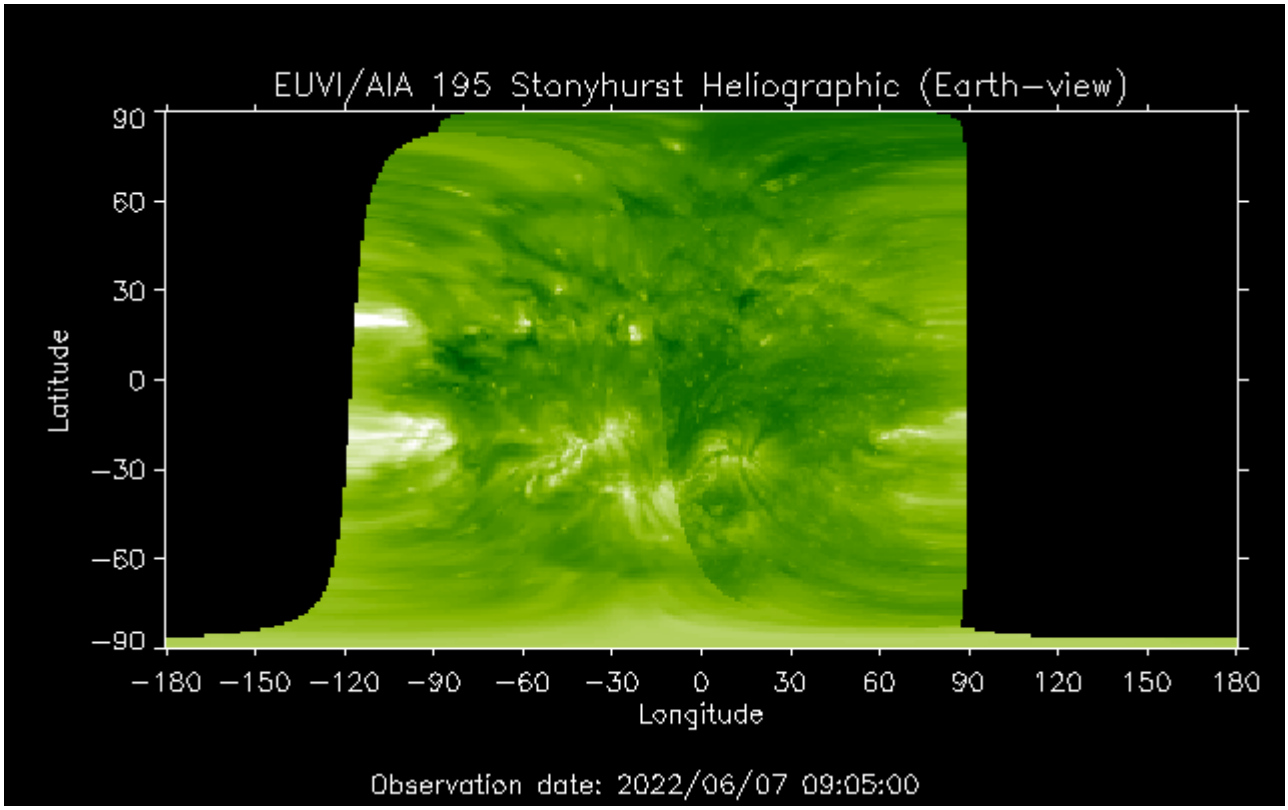
© Crown Copyright 2022. All Rights Reserved.

Radio Blackouts - X-Ray Flares:
There are now just two numbered sunspot regions on the Earth-facing side of the sun, with both of these unproductive and unipolar. In addition to these groups, a small bipolar region developed in the southwestern quadrant in the UTC day of Monday 06 June, slightly to the east of the now-departed Ex-AR3023 and 3024.

The current disc offers little in the way of likely sources of activity - barring significant development - however STEREO A EUVI195 imagery does hint at possible returning region(s), including Ex-3010 and Ex-3011, 3015 and 3014 in turn during the four-day period. This is the rationale for the slight uptick in the risk of M-class flares in the forecast, although this is effectively a placeholder pending any regions crossing the eastern limb for analysis.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	1	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: STEREO A EUVI 195 shows returning bright flux regions potentially due to rotate onto the Earth-facing disc in the few days.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is at background levels and is expected to remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) saw its oscillation attenuated through the UTC day of Monday 06 June, with its new character mostly within Normal Background. The 24-hour integrated fluence reacted in kind, falling sharply from an early peak above Active to finish the 24 hours comfortably below.

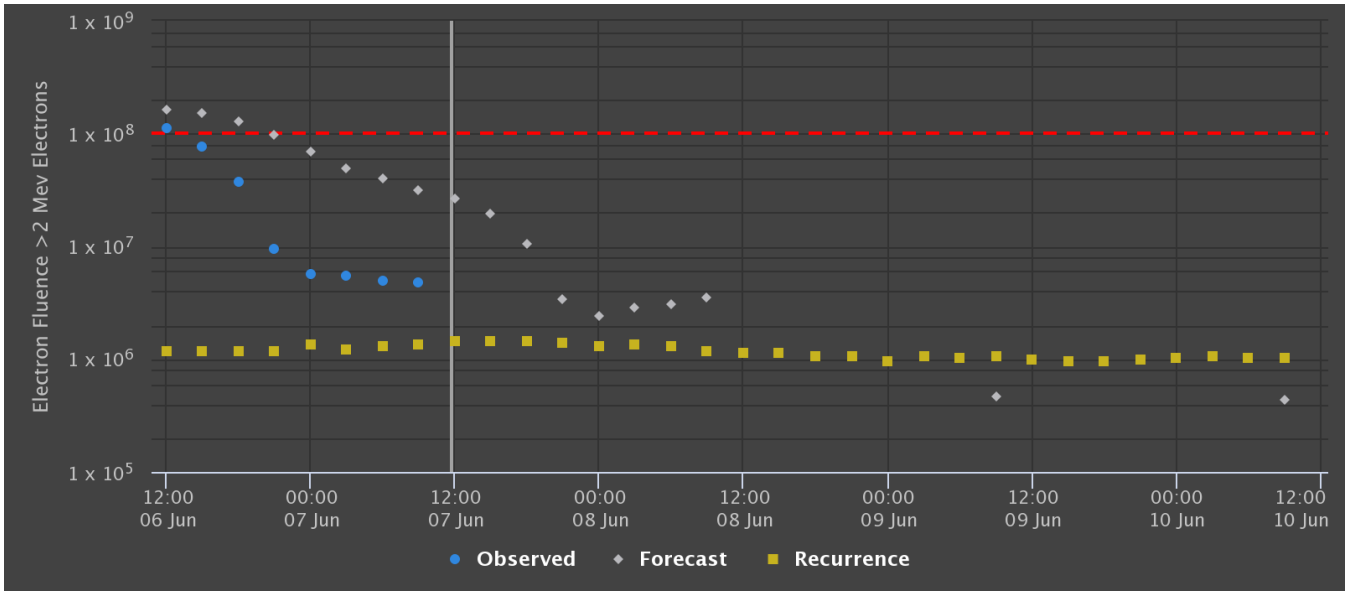
A slight increase in both flux and fluence may begin to show itself once geomagnetic activity from the current CME begins to wane on day one, Tuesday 07 June, however the slow solar wind environment is very unlikely to be capable of supporting much more than Moderate flux, and any further crossing of Active fluence is not likely until the next sizeable coronal hole - something absent from the whole disc at present and therefore perhaps at least a week away.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	10	20	20	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

Figure 4: MOSWOC REFM electon fluence – observations and forecast.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.